
Joint Venture Opportunities Relating to Alberta Oil and Gas Equipment and Services

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Overview of Alberta Oil and Gas Industry

ALBERTA'S OIL AND GAS INDUSTRY

Alberta's terrain ranges from flat drylands in the south, to prairie in the southeast, to heavily forested mountains in the west, to thick forests with limited access in the north. Temperatures vary from +30° C (86° F) in the southern part of the province in summer to -40° C (-40° F) in the northern parts in winter. This diverse terrain and climatic condition made it necessary for Alberta manufactured oil and gas equipment to be adaptable to all conditions.

Oil and gas equipment manufactured in Alberta has already been proven in the rain forests of Ecuador, the Siberian winter, offshore in the North Sea, Indonesia and Canadian high Arctic, as well as in desert conditions in the Middle East and Africa.

Innovative technology and design, combined with high quality and durability, are the by-words of manufacturers in Alberta. This has gained them a world-wide reputation for excellence in a wide range of equipment manufactured for both the domestic and international markets, comprised of seismic, drilling, servicing and production equipment, gathering systems, gas plants, refining and transmission lines. All equipment is manufactured to American Petroleum Institute (A.P.I.) specifications and subject to rigid quality control inspections throughout final assembly.

World renowned seismic interpretation, simulation design, enhanced recovery, safety and wild well control services and the design of gathering and transmission lines are only some of the services offered by Alberta companies. Gas plant and refining design incorporate the latest in energy saving innovations as well as the most up-to-date automated controls.

Alberta has some of the world's highest concentrations of hydrogen sulfide (H_2S) in its natural gas fields (up to 90 percent), and the industry in Alberta has developed specialized equipment and services to meet this challenge. Safety records in Alberta sour gas fields are unequalled anywhere in the world and engineering services are offered for the design of sulfur recovery systems and the "prilling" of sulfur for delivery to any markets.

Technological advances, both upstream and downstream of the wellhead, developed by Alberta's oil and gas equipment manufacturers and service industry have enabled them to successfully market their equipment, technology and services internationally.

Although Alberta is a land-locked province, the gas and oilfield equipment manufacturing and service industries of Alberta have developed the expertise to undertake marine offshore projects. These projects range from ice island construction and arctic ocean drilling sites to specialized arctic explorations, drilling equipment design and manufacturing, as well as conceptual designs and engineering for offshore production systems and strengthened ship hull design.

Whether there is a need for helicopter transportable seismic drills and associated geophysical equipment, conventional drilling and servicing rigs or those that are designed to be transported by cargo aircraft, Alberta industry is ready and capable of meeting the challenge. Alberta can also supply offshore drilling and production equipment and design, heavy oil recovery, secondary and tertiary recovery, gas and oil gathering and transmission lines, facilities for oil refining as well as gas plant design and construction.

CRUDE OIL

While crude oil and natural gas have been produced in Alberta for local consumption since the turn of the century, the largest and most productive oilfields have been discovered only during the past 30 years. At the beginning of 1990, Alberta's remaining recoverable reserves of conventional crude oil were estimated at 560.5 million cubic metres (3.5 billion barrels). Most of these reserves are of light and medium gravity, with a low sulphur content, and are produced in fields in the central and northwestern parts of the province. Smaller amounts of heavy gravity crude oil are present in east, east central and southeastern Alberta. Net production of crude oil (and equivalent liquids) in 1989 was 66.8 million cubic metres (420 million barrels).

NATURAL GAS AND LIQUID CO-PRODUCTS

Abundant deposits of natural gas are found in many areas of Alberta. Total remaining recoverable reserves, as of the end of 1990, were estimated at 1.65 trillion cubic metres (58.6 trillion cubic feet), with ultimate recoverable reserves estimated at 3.2 trillion cubic metres (113.8 trillion cubic feet).

Natural gas fields in various areas of the province contain some 517.5 million cubic metres (18.3 billion cubic feet) of remaining recoverable reserves of propane, butanes and pentanes plus.

In 1989, approximately 85.8 billion cubic metres (3.0 trillion cubic feet) of natural gas were produced.

Many of the natural gas reserves are wet and/or sour, containing an abundance of liquid co-products (propane, butanes and pentanes plus) and sulphur. During the past 25 years, the petroleum industry has developed a highly sophisticated technology designed to process wet and sour gas to remove the liquid co-products and sulphur. As a result, Alberta produces approximately 95 percent of Canada's pentanes plus, propane and butanes.

At present, there are nearly 600 gas processing plants in Alberta where the gas is stripped of its by-products and upgraded to pipeline quality. Additional processing capacity is being provided by the expansion of existing facilities and the construction of new plants.

OIL SANDS AND SYNTHETIC OIL

Canada's largest oil sand deposits are found in northeastern Alberta, adjacent to the Athabasca River, where beds of oil sands are exposed at the surface. The Athabasca area contains some 114 billion cubic metres (712 billion barrels) of oil of which approximately 4 percent, or 3.9 billion cubic metres (24.5 billion barrels), is recoverable using present open pit mining and extraction technology. Two plants are currently producing from these deposits, collectively producing approximately 35,000 cubic metres (220,000 barrels) per day of high grade synthetic crude oil. A third major oilsands mining and upgrading project, known as "OSLO", is currently being engineered. It is designed to produce 12,500 cubic metres (80,000 barrels) per day.

Deeper deposits are being developed by what is known as "in-situ" techniques. This involves the injection of air to support underground combustion, or steam to mobilize the oil, enabling it to flow to the surface. In 1990, there were seven commercial in-situ recovery projects operating in the province, extracting approximately 6.4 million cubic metres (40 million barrels) of bitumen annually. There are also over 30 active experimental projects in 1990, producing about 1.1 million cubic metres (7 million barrels) of bitumen annually.

Remaining established reserves of synthetic oil in Alberta are approximately 4.2 billion cubic metres (30 billion barrels). This is equivalent to about one half of the world's established reserves of conventional oil.

PIPELINES

Canada's pipeline industry today is a complex, highly automated operation and the pipeline infrastructure for the transportation of crude oil, natural gas, and refined products extends across the nation. The two major oil and natural gas pipelines in Canada, Interprovincial Pipe Lines and Trans Canada Pipe Lines respectively, are now over 30 years old. The pipeline infrastructure continues to be expanded and upgraded. Canada also has world-class pipeline technology and pipeline services, particularly for natural gas, and this technology is exported around the world.

Interprovincial Pipe Line Ltd. began moving crude oil from Edmonton, Alberta to Superior, Wisconsin, a distance of 1,820 kilometres (1,130 miles) in 1950. By the mid-1980s, Interprovincial Pipe Line, together with its U.S. affiliate, the Lakehead Pipe Line Company, extended 2,300 miles from Edmonton, Alberta to Montreal, Quebec. The Interprovincial-Lakehead system is the world's longest crude oil pipeline.

Pipelines which extend beyond the boundaries of one or more provinces or cross the international border with the United States are regulated by the National Energy Board of the Canadian Government. The Alberta Energy Resources Conservation Board and the Public Utilities Board have regulatory responsibility in relation to the construction and expansion of pipelines and over tolls and tariffs for pipelines operating within Alberta.

Alberta itself has a well-developed pipeline network which ensures delivery of oil and gas resources to markets. The province is criss-crossed by more than 180,000 kilometres (112,000 miles) of pipeline. Pumping stations and compressor stations are located at various points to move oil and gas to their destinations. The major crude oil pipelines operating in Alberta include Interprovincial Pipe Line, Trans Mountain Pipe Line, and the Rangeland Pipe Line. The major natural gas pipeline operating in the province is the NOVA pipeline system; and the principal refined products pipeline is the Cochin pipeline.

Exploration Equipment and Services

EXPLORATION EQUIPMENT AND SERVICES

Exploration equipment manufactured in Alberta, includes carrier mounted exploration drilling rigs, drilling bits, environmentally controlled cabs to house instruments and operators in adverse climatic or topographic conditions, tricone rock bits and drag bits for the geophysical industry, specially designed surface source impulse equipment and associated geophysical shooting and recording equipment. Alberta manufacturers of exploration equipment also produce specialized off-road equipment with either track or rubber tired undercarriage, as well as doppler satellite positioning systems for seismic vessels.

Many Alberta companies enjoy a good international reputation for their technological advances and innovative approaches to software design for seismic interpretation. Software development is ongoing for geophysical data processing which expedites the conversion of huge amounts of seismic wave information into stratigraphic sections, which is then further processed by high speed computers. Development is also underway of systems with better resolution of seismic data which will enable geologists and geophysicists to determine small ecological anomalies which may contain hydrocarbon accumulations. Exploration equipment manufactured in Alberta, as well as services designed within Alberta, are presently used internationally.

EXPLORATION EQUIPMENT

Seismic drilling equipment manufacturers in Alberta make a complete line of portable drilling rigs capable of drilling from 20 to 700 metre depths (65.6 to 2,296.6 feet). One drill specially designed for seismic exploration work is a top drive auger unit capable of drilling to 100 metres (328 feet).

These auger drills handle ten foot lengths of drill pipe and are self contained units, eliminating the need for water trucks and extra personnel on the drilling sites. Seismic drilling rigs can be mounted on trucks or off-road rubber tired or track equipment, according to the customer's requirements and specifications.

Rotary-type drilling rigs manufactured in Alberta are capable of drilling from 300 to 700 metres (984 to 2,296.6 feet) and are specially designed for ground water development, mineral coring and petroleum exploration applications. These larger drills are available with either duplex or triplex pumps and can be custom designed to meet customer requirements. All

companies offer a complete line of spares with their drilling packages and many stock over two million dollars worth of spares in their Alberta manufacturing facilities.

Specialized instrument cabins incorporating the latest in electronic technology are another product of Alberta manufacturing. These cabins are designed to be used in any climatic conditions and incorporate the latest technology available to maintain the internal environment. These cabins can be designed to meet customer requirements, can be mounted on all types of carriers and are suitable for offshore installations.

A number of Alberta companies manufacture accommodation units for small field crews. These units are custom designed to customer specifications.

A full complement of geophysical electronic equipment is manufactured by Alberta companies, along with the associated equipment necessary to undertake geophysical surveys.

Alberta manufactured seismic equipment is presently used in many countries, such as Pakistan, Indonesia, Russia, China, Venezuela, Kenya, and the United States.

EXPLORATION SERVICES

Alberta-based geophysical companies offer comprehensive geophysical data acquisition services. These services include the supply of equipment and personnel experienced in working in the most difficult environment or terrain. Many of these companies share extensive international experience.

New technology in marine seismic data collection developed in Alberta includes digital streamers using fibre optics and space-age electronic modules.

Alberta-based firms have undertaken seismic data collection in the United States, Australia, and the Middle East, as well as for marine projects around the world.



Drilling and Servicing Equipment

DRILLING AND SERVICING INDUSTRIES

Alberta is the headquarters for some of the world's largest drilling rig and associated equipment manufacturers. Innovative design and technology, combined with durability and quality, have been the mainstay of the drilling and servicing industries in Alberta. Manufacturers have designed equipment which operates under severe climatic conditions and is easily transportable by both conventional means and by air.

DRILLING RIG MANUFACTURING

Drilling rig manufacturers in Alberta are able to design and fabricate rotary drilling equipment to meet customer specifications, using computer programs to analyze the engineering design of their products. These products include masts, draw works, mud pumps, rotary tables, swivels, drive groups, travelling blocks and crown blocks. If required, standard rig packages which meet the same exacting specifications are available. Alberta drilling rig manufacturers also offer drilling packages on a turn-key basis to both international and domestic customers.

Many companies provide a full range of drilling equipment from the smallest portable rigs to the largest of the ultra-deep rigs capable of drilling to 17,000 metres (55,800 feet). Alberta manufacturers are leaders in the development of engineering required to build today's super rigs. Drawworks are available up to 4,000 horsepower and travelling blocks are designed for loads up to 1.13 million kilograms (1,250 tons).

Mast designs include free standing, telescoping, angle leg, slingshot and more. Substructure designs range from box type to jack-knife design, according to customer preference.

Mud handling pumps are tailored to customer specifications and requirements.

Some manufacturers also produce ram-type blow out preventers that are compact and lightweight, provide reliable operation with ease of maintenance, and feature a simple hydraulic actuating system with no external hydraulic lines exposed to damage. These blow out preventors are ideal for well servicing work-over operations.

All drilling rig packages are engineered with the operator in mind and the components are fabricated to facilitate ease of moving; in the fewest possible loads.

To serve the offshore industry, manufacturers offer derricks and masts for drill-ships, semi-submersibles, jack-ups, drilling platforms, and inland barges. Designs include telescoping and vertically assembled masts for use on offshore drilling and production platforms. Completely enclosed derricks manufactured in Alberta are in service on a number of North Sea platforms. All companies are authorized to use the official monogram of the American Petroleum Institute on derricks, masts and substructures manufactured in accordance with A.P.I. standard #4E, "Drilling and Well Servicing Structures."

The design, manufacture, test assembly and commissioning of offshore rig packages for shallow drilling and work-over are available and conventional, as well as innovative designs permit fast relocation of land rigs.

Special rig moving systems are manufactured for use both on land and offshore, ranging from some of the most sophisticated wheeled desert rig movers ever built to skid systems for land and offshore platforms.

SLANT HOLE DRILLING RIGS

The slant hole drilling rig was developed to enable oil and gas producers to drill targets which were previously thought inaccessible. This allows drilling under lakes and urban areas where it would previously have been impossible to obtain oil and gas production.

While slant hole drilling is not new, a number of Alberta drilling rig manufacturers have developed innovative slant hole drilling rigs that employ the newest technology available to the industry. Innovations range from radically new designs, incorporating advanced electronic technology, to design changes on existing equipment that enable the rig to be operated by fewer personnel and to be moved to new locations easily. A special advantage offered by slant hole drilling is that up to 30 holes can be drilled from one location, depending upon spacing requirements.

Some of the new innovations include designs that permit a high degree of automation, new concepts in pull-down systems and redesigned auxiliary equipment that facilitates drill pipe handling.

Many of these slant hole rigs are presently working in the field and proving to be exceedingly cost effective. Some of the advantages they enjoy are that they are extremely portable and require a very small crew to operate them.

As well, some of these slant hole drilling rigs can be used for tunnelling, horizontal drilling, and construction purposes beside their obvious applications for oil and gas exploration.

In addition to slant hole drilling rig manufacturing, Alberta companies have developed slant hole pumping equipment specifically for production from slant hole wells.

Other innovations developed by Alberta manufacturers include the design and manufacture of compact, light weight, small bore drilling rigs. These rigs drill small diameter holes, as small as 73 millimetres (three inches), faster than conventional rotary drilling rigs. This means that a well can be drilled and completed in a short time, thereby offering substantial savings in drilling costs.

The light weight makes them suitable for use on difficult terrain, and their low surface profile and relatively low noise levels, make them ideal for deployment in urban environments. Their compact size allows for transportation by light aircraft, helicopter, or truck.

DRILLING RIG PLATFORM ENGINEERING AND DESIGN

A number of engineering and consulting firms in Alberta have internationally renowned expertise in providing drilling and frontier production-related engineering services to operating companies, service companies, and institutions in the oil and gas sector. Alberta companies also have international reputations for offshore and arctic drilling, and platform design. Alberta engineering firms are able to undertake feasibility studies, preliminary design and cost estimates, detailed drawings, construction specifications, equipment specifications, as well as procurement and construction supervision. These engineering consulting firms also offer start-up assistance, all operating manuals, project operation and management. Design and supervision of construction of offshore production platform-mounted drilling rigs in the United Kingdom, Norway, and Australia, have been completed by Alberta firms. Creative design and technology has enabled companies to develop several sub-sea drilling installations in the Canadian Arctic.

DRILLING DRAWWORKS

Many Alberta companies design and manufacture primary drive groups and drawworks. Some also utilize their self-designed drive groups as they are thought to be more reliable than conventional roller chain systems.

The largest drawworks currently available to the drilling industry was designed and built in Alberta. It offers a hoist capacity of 4000 input horsepower that permits lowering casing strings of up to 1.14 million kilograms at 9 metres (1256.3 tons) per minute. Other designs include single speed drawworks as small as 200 horsepower, and special helicopter-transportable drawworks. Independent rotary drive packages, incorporating integral mounts for hydraulic cat-heads and/or an iron roughneck are available, and a full range of wireline anchors are also offered.

The many years of design and field experience of Alberta drawworks manufacturers ensure products that are well suited to rigs requiring fast moves and quick rig-ups, thus contributing to an overall cost reduction in drilling of gas and oil wells.

SPECIALIZED MUD MIXING PUMPS

Horizontal and vertical centrifugal pumps manufactured in Alberta are tailored to suit all abrasive/corrosive fluid handling problems. A selection of wear-resistant materials in their construction, in combination with the basic principles for operation of pumps, allow for less maintenance and extended pump life.

Horizontal centrifugal pumps are designed primarily to handle surface mud systems in the drilling industry. The overall dimensions of these pumps permit alterations on existing systems during the installation.

Alberta firms have developed a totally replaceable bolt-in liner set and impeller. Now available in a polyurethane material, they offer five to ten times the life presently available from most pumps found in the drilling industry. When replacement is required, impellers and liners are easily changed in a short time.

Vertical centrifugal pumps that can be mounted inside mud tanks, thereby eliminating the need for suction lines, offer simplicity in design and rugged construction. The cantilever shaft used in these pumps eliminates any submerged bearings, mechanical seals or stuffing boxes. The impeller is double sided, and double suction prevents air locking. During operation, the pump agitates the sump's contents slightly, thus eliminating the hand cleaning of sumps. Designed specifically with the drilling industry in mind, these heavy duty vertical pumps are constructed to take punishment, yet offer portability due to their light weight.

By fully understanding the drilling industry's requirements, engineering personnel maintain Alberta's oil and gas equipment manufacturers' ability to solve difficult pumping problems.

DRILLING TOOLS

While downhole tools have been in use for many years, manufacturers in Alberta have re-designed many of them to ensure their reliability. Innovations include designs that enable easy and quick field servicing. Tool rental costs are reduced because fewer tools need to be on the drilling site.

Oil tool companies in Alberta manufacture a complete range of downhole tools, from stationary seal shock tools designed to isolate drill strings from axial deflections, produced by the bit during drilling operations, to combination drilling jars that are hydrostatically assisted. The range of tools also includes fishing jars and jar accelerators, designed to store the energy created by the pull on the drill stem that releases energy to accelerate the drill collars upward when the jar releases. Also manufactured are hydraulic/mechanical drilling jars, as well as teamers, stabilizers, shock subs, fishing jars and bumper subs.

WILD WELL CONTROL AND SAFETY SUPERVISION

Several Alberta engineering and consulting companies offer safety inspections and consulting for all phases of the oil and gas industry. Some of these firms specialize in safety programs in hydrogen-sulfide control and are leaders in their field in developing gas plant safety programs.

Expertise has been developed that provides the oil and gas industry with emergency response services for production facility fires, severe oil and gas blow outs and standby fire protection during high hazard operations.

Specialized truck-mounted equipment is manufactured in Alberta that can be flown anywhere in the world to meet any oilfield emergency. This equipment incorporates the latest in fire suppression technology.

Service Equipment

SERVICE EQUIPMENT

Service rigs designed and built by Alberta manufacturers incorporate the operator's viewpoint to ensure ease of operation while working in a wide variety of terrains and climates. The creative and practical approach of many companies to design and manufacturing, combined with a dedication to excellence and a belief that rigs should be built to suit customer requirements, has established Alberta service rig manufacturers as reliable and competent international suppliers of this type of equipment.

Service rig manufacturers in Alberta offer a full range of equipment with ratings from 1,000 to 7,600 metres (3,281 to 24,934 feet).

Spudding units, driven by customer specified motors, are designed to be mounted on conventional truck chassis, trailers or off-road carriers.

Rigs manufactured in Alberta have been delivered and are operating in all major gas and oilfields in the world, including South East Asia, Africa, the Middle East, South America, Australia, the United States, and of course, throughout Canada.

These manufacturers employ skilled teams of engineers who can design equipment to the exacting specifications of their customers, and teams of technicians to supervise final assembly and offer full after-sales service. Many Alberta manufacturers have undertaken joint ventures with regards to the operation of oilfield service companies, and are able to offer these services together with the equipment they manufacture.

ACIDIZING, CEMENTING AND FRACTURING UNITS

Field experience, combined with cutting-edge engineering and design enable many Alberta companies to manufacture a wide range of oilfield servicing equipment, including fracturing pumpers, blenders, cement/acidizing pumpers, coiled tubing units, hot oil units and nitrogen pump units. In addition, a full line of industrial cleaning equipment, which consists of chemical units, water blasting and jetting units, heat exchanger bundle cleaning equipment, plus various automated and semi-automated ancillary equipment, is available.

Specialized well servicing plunger pumps are designed to meet the pressure/volume requirements for well servicing, acidizing and cementing. These pumps are light weight and compact, furnished with gear ratios to permit ease of unitization with engines and transmissions or electric motors.

Cementing is one of the most important functions performed by qualified well service companies. Design, product blending, equipment operation, field personnel, and timing; all are required to place quality cement products downhole.

Various Alberta companies provide a complete cementing service, including equipment and training. The people, the products and the equipment are all backed by training and testing facilities, as well as specific engineering expertise.

Testing of new products, coupled with product improvement, are of paramount importance in laboratories. The deeper, hotter wells now being drilled, require strict quality control standards and improved procedures to cement at high temperatures and pressures.

Nitrogen, a common component of air, provided the vehicle by which one Alberta-based cementing, acidizing and fracturing company first entered the oilfield service business. An off-shoot of space technology, positive displacement cryogenic pumps (capable of handling fluids at temperatures as low as -212°C (-350°F) were introduced to the Western Canadian oilfield service industry in 1962, and have since gained world-wide acceptance. Nitrogen is transported to the well site as an extremely cold liquid and is then pumped and heated to a warm gas at high pressure, suitable for use in a wide variety of operations.

Since first patented, the use of nitrogen in well completions has had a spectacular history. Many diverse extensions of nitrogen technology have since been identified and developed, such as well bore clean-up and use of nitrogen to detect gas leaks in wellheads, tubular goods, flowlines and complete gas plants.

Today, few wells will produce without some form of stimulation. Acidizing, the basic "clean-up" function, is therefore applied to almost every well drilled. In addition, a large number of the world's producing formations are calcareous in nature and must be stimulated with acid. Volumes used range from approximately 1,000 litres to millions of litres (a few hundred gallons to hundreds of thousands of gallons).

As exploration costs escalate and less productive reservoirs are discovered, research and engineering staff are continually researching more efficient and cost-effective treatments for these wells.

New fracturing systems and fluids, which have made productive many otherwise non-commercial reservoirs, have been developed and/or patented by Alberta companies. These include foam fracturing, combination fracs, foamed acid, foamed hydrocarbon fracturing and sand-intensified foam fracs.

Computer simulation of treatment recommendations has recently become another technical tool used by the industry to optimize fracture treatment design, as fluid selection and proppant requirements are critical in maximizing well productivity.

Endless tubing units, first introduced in 1970, have since become an integral part of many well completion operations, both onshore and offshore. These mobile units provide a fast and effective method of running several thousand metres (several thousand yards) of continuous, jointless, small diameter pipe (up to 3.25 centimetres (1.3 inches)) into the wellbore, against wellhead pressure.

Engineering groups, acting as liaison between the company and the oil and gas industry, provide technical design and programming for all field operations. These groups are fully supported by continuing research, originating both within the companies and outside them, i.e. from other sectors of industry. In addition, many companies provide computer service facilities, both in-house and from other sources, which further enhance the high degree of technology necessitated by the oil and gas industry.

Companies manufacturing equipment offer training in both equipment operations and in the design of stimulation programs. Training can take place both at the manufacturing/service facility, or at the customer's own facility.

All manufacturers thoroughly test all equipment under field conditions, before delivery. Reliability is the by-word of these companies. Alberta designed and built equipment has been sold to operators in Africa, India, Pakistan, Ethiopia, and Korea.

OFF-ROAD VEHICLES

Off-road equipment manufactured in Alberta enjoys an international reputation of excellence. A diverse range of tracked and low ground bearing pressure tired vehicles is available.

Depending upon need and utilization, the carrying capacity of tracked equipment ranges from 3,600 to 36,000 kilograms (3.97 to 39.7 tons). This tracked equipment is available in a myriad of configurations.

Wheeled units have payloads ranging from 900 to 63,000 kilograms (1 to 69.4 tons) and are also available in many configurations.

Applications of this equipment range from carrying personnel to moving drilling rigs and associated equipment.

Off-road equipment manufactured in Alberta is in use in many countries throughout the world, including South East Asia, South America, Soviet Union, Antarctica and the Middle East, as well as the United States and the Canadian Arctic.

RELOCATABLE SHELTERS

Alberta is home to the world's leading manufacturers of relocatable shelters. These shelters are used for drill camps, construction camps, complete hospital facilities, as well as office and commercial structures which can be transported by conventional means or by air.

The engineering and design departments of relocatable shelter manufacturers are able to design structures to any requirements. Be it the High Arctic, the Middle East, South America, Australia, or Antarctica, Alberta manufactured structures are there.

Production Equipment and Services

PRODUCTION EQUIPMENT AND TESTING SERVICES

Alberta companies manufacture production testing packages for international markets that are portable, handle high working pressure and operate in severe climatic conditions. Production testing equipment is designed to meet customer needs, on any continent, in any weather.

The design and fabrication of gas and oil testing and production equipment is an important component of Alberta's oil and gas manufacturing sector. Many companies also provide specialized services to the oil and gas industry in well testing and reservoir evaluation for land and offshore operations.

Fabrication in accordance with the specifications of the ASME Code, is standard. Equipment designed and manufactured in Alberta includes the following:

- Recycling separators that solve many gas cleaning and liquid recovery problems, are highly reliable, small in size and efficient. They have no moving parts and are particularly economical where the service conditions include high pressure.
- Designs in involute oil separators which give better gas break-out and performance, are proven to reduce internal foam while reducing the on-stream retention time required for separation.
- A unique smokeless burner system that uses the inherent energy of the flowing system to effect atomization and air induction of smokeless combustion of hydrocarbon liquids and gases.

Some companies specialize in modular construction of their products. The equipment is compact and therefore can be shipped in smaller modules to field installations and is especially suitable for offshore operation where platform space is confined.

Specialized production equipment, manufactured by Alberta companies, is used around the world. The research and development components of their engineering staff are constantly making improvements on existing technology so as to obtain optimum results from their products. This equipment ranges from specially designed high pressure pipe couplers to sophisticated wire line equipment.

Innovative electronic controls and monitoring devices for production equipment are also used as components in seismic equipment, drilling and seismic rigs, production testing equipment, and gas plants.

Alberta companies have exported this type of equipment to countries in South East Asia, South America, the Middle East, Eastern Europe, and the Pacific Rim.

Innovative Technology

ENGINEERING AND TECHNOLOGY

Engineering in resource development requires teams of professionals who provide engineering, consulting and computer software to the energy industry. Their products and professional services must determine the most feasible and economical methods of recovering, gathering, and transporting petroleum products, ranging from heavy gravity crude oil to natural gas. Alberta engineering firms have developed sophisticated reservoir simulation models to determine the amount of recovery from oil and gas fields. Through the years, these companies have continued to improve their simulation tools to keep at the leading edge of this rapidly growing technology. Reservoir engineering expertise is available to clients for all types of reservoir problems ranging from how to design a test on a gas well, to a detailed compositional reservoir simulation study, using the most recent technology.

Geological and petrophysical engineering is aided by computer technology that provides consistent computer evaluation of well logs through log analysis systems. Some of the services included are individual well or log analysis, regional geology interpretation, geometric studies to establish the structural style and three dimensional reservoir continuity, petrophysical studies to determine the variability of the reservoir raw quality, and co-ordinated studies to develop the hydrocarbon pre volume and fluid transmission patterns.

Alberta firms offer a wide range of petroleum resource planning, including facilities engineering and conceptual design of oil and gas processing plants, gas dehydration facilities, compressor stations, vapour recovery and secondary recovery systems.

Periodically, engineering firms conduct short courses in areas in which they offer consulting services and training sessions to petroleum companies. These include reservoir simulation, enhanced oil recovery, pipeline engineering, geological and petrophysical engineering, hydraulic fracturing, and energy economics. Such courses are tailored to the needs and the expertise of the client company. Upon request, these courses can be presented in any country.

GAS PLANTS DESIGN AND ENGINEERING

Technology has been developed in Alberta to facilitate construction of gas plants.

Engineering and design have incorporated the latest technology, automation, instrumentation and safety features. These designs reduce significantly the number of plant personnel needed as operators, thereby offering substantial savings.

An innovative approach to modular design and assembly of package gas processing plants has been developed in Alberta. The advantages of designing and manufacturing modular units are the reduction of field construction time and adherence to a high level of quality control standards.

Special advantages of the modular approach are the standardized engineering compact unit size, and saving of material costs. Construction site work stoppages due to inclement weather are reduced as a minimum of on-site work is required. A higher productivity rate, as well as a greater degree of quality control, can be achieved in a manufacturing facility than can be obtained under job site conditions. The modulars can be shop tested to ensure that all components are ready for start-up, thereby eliminating a great deal of on-site problem solving.

ENHANCED OIL RECOVERY

Enhanced oil recovery projects in many areas of the world have been undertaken by Alberta engineering firms.

These firms are comprised of highly skilled engineers and technologists who develop computer models to help determine the optimum fluids required for injection into a reservoir to achieve miscible enhanced recovery.

Enhanced or tertiary oil recovery methods require more advanced technology than primary or secondary methods and more sophisticated procedures for analyzing oil extraction.

Unique computer modelling systems developed by Albertans are applicable internationally and could be integrated into the control systems to optimize the performance of new facilities. Optimization means regulating controllable elements of the system to meet specific performance objectives.

ALBERTA OIL SANDS TECHNOLOGY AND RESEARCH AUTHORITY

The Alberta Oil Sands Technology and Research Authority (AOSTRA) was formed by the Alberta Government to develop new technology for the recovery and processing of petroleum from Alberta oil sands. This mandate has since been amended

to include the recovery of heavy oils and the enhanced recovery from conventional petroleum reserves.

This authority enters into joint ventures and research with international companies. One such venture is the entry of AOSTRA into an agreement with a number of Japanese companies to test the performance of a high conversion cracking process on Alberta bitumen in an existing pilot plant in Japan.

OIL SANDS

Pioneering innovative technology is the motto of the oil industry in Alberta. Technology developed in Alberta for both the mining and production of oil from oil saturated sands and for heavy oil recovery may be used in any country that has oil deposits of this type. This technology now allows the production of oil from deposits that previously were thought non-recoverable.

Some of the world's largest oil reserves, which are in saturated sand deposits, are located in Alberta. The shallowness of the overburden on top of these oil sands makes it possible for the recovery of oil by surface mining. Mineable deposits, that is, those which lie under 76 metres (249 feet) or less of overburden, cover approximately 480 square kilometres (185 square miles). The basic procedure is to mine the oilsands and recover the bitumen via a hot water extraction process. This procedure involves mixing the oilsands in revolving drums with hot water and caustics such as sodium hydroxide in high temperatures. The resulting thick liquid slurry is screened and pumped into separation tanks where most of the bitumen rises to the surface.

This floating bitumen is drawn off and secondary separation is undertaken — heating it and diluting it with naptha to make it flow more readily. It is then put through a centrifuge to remove coarse solid clays and remaining water. The clean bitumen is then run through a dilutant recovery unit to remove the naptha and stored in heated tanks to await upgrading.

Research and pilot projects on in-situ recovery methods are presently underway — some in co-operation with Japan.

HEAVY OIL RECOVERY

Over 90% of bitumen is buried under 200 metres (656 feet) or more of overburden. The estimated recoverable reserves are 32 billion cubic metres (200 billion barrels). The major obstacle to recovery of this bitumen, is that it is very viscous and too thick to flow. Field laboratory research over the years has shown the most efficient way to overcome this problem is by the use of thermal in-situ methods, with the application of heat to the bitumen where it lies in the ground. The heat increases the mobility of the bitumen, allowing it to be separated from the sand. The pressure of injected steam or oil, forces the oil to flow toward a collection point from which it can be pumped to the surface. To increase the pressure, steam is sometimes used in combination with fire flood.